

Diana Worthen, PE
Cascade Trenchless Consulting LLC
diana@cascadetrenchless.com

Professional Registrations

Professional Engineer: California, 2012 (No. 80871)
 Oregon, 2015 (No. 89915PE)
 Washington, 2015 (No. 52401)
 Texas, 2019 (No. 135183)
 Idaho, 2021 (No. P-20238)

Distinguishing Qualifications

- ◆ Skilled in trenchless planning, design, and construction support for a variety of construction methods including: horizontal directional drilling (HDD), auger boring, pilot tube guided boring, pipe ramming, open shield tunneling, and microtunneling
- ◆ Experienced in risk management for trenchless projects, including preparing Geotechnical Baseline Reports
- ◆ Strong background in tunnel construction inspection for a range of trenchless construction methods
- ◆ Skilled in site conceptualization of subsurface conditions and leading geotechnical investigations

Relevant Experience

Diana is an experienced trenchless engineer specializing in delivering trenchless projects from conceptualization through construction. She has roots in the Puget Sound area, and is currently based in Portland, Oregon serving the Pacific Northwest and beyond. She has over 12 years of experience in geotechnical and trenchless design, analysis, risk management, and construction inspection for conveyance and energy projects throughout North America. She integrates with project teams to provide trenchless expertise with a focus on collaboration, quality, and risk mitigation.

Diana delivers trenchless solutions for pipeline projects through conditions ranging from steep and rocky terrain, to sensitive soft clays, to loose, dry sand. With a geotechnical background, she has developed a deep understanding of trenchless design in the broad picture down to the details of the calculations. She partners with clients throughout all stages of trenchless projects, specializing in identifying and mitigating risk while developing alternatives specifically suited to the needs of the owner and the project site with a careful attention to detail. This includes geotechnical investigation, feasibility and alternatives analysis, implementing risk mitigation measures, developing contract drawings and specifications, and supporting construction through document review and on-site inspection.

Representative Project Experience

Lead Trenchless Engineer & Field Inspection Engineer; PacWave South; Oregon State University; Waldport, Oregon; 2020 to 2022. Trenchless lead for 2,340-foot HDD installation of a bundle of 6-inch and 2-inch HDPE pipe for electrical cable conduit. Design peer review and on-site construction inspection for four off-shore installations of 5,240-foot 8-inch steel conduits for electrical cables. Conduits are infrastructure for a planned off-shore testing facility for wave energy generation. Developed subsurface characterization and designed and analyzed HDD alignment geometry and pipe stresses, and risk of inadvertent returns. Design services included preparation of design drawings and specifications. Services during construction included submittal review, on-site inspection, and troubleshooting construction issues as part of a design-build team.

Lead Trenchless Engineer; Nampa Wastewater Plant; City of Nampa; Nampa, Idaho; 2019 to 2022. Trenchless lead for design of 300-foot 78-inch microtunnel installation for undercrossing of six UPRR tracks for recycled water pipeline. Planned and performed geotechnical investigation. Collaborated with geologist and geotechnical engineer to develop subsurface characterization. Analyzed alignment and trenchless technology alternatives. Prepared drawings and specifications, and Geotechnical Baseline Report.

Lead Trenchless Engineer; Port of Moses Lake Wastewater Pond No. 3; Port of Moses Lake, Washington; 2020 to 2022. Trenchless lead for design of a 72-inch-diameter trenchless installation of a steel casing for inlet, outlet, and drain line piping to service a new wastewater storage lagoon. A trenchless solution was required to avoid the classification of the lagoon wall as a dam, which would have incurred long-term maintenance requirements. Supported the preparation of several documents on behalf of the client to define design requirements from the Washington Department of Ecology regarding dam classification. The design allowed for the option of pipe ramming, open-face rotary wheel tunneling, or open shield tunneling, at a length of 134 feet or 484 feet in ground conditions consisting of sand and gravel with cobbles. The contractor opted to pipe ram 134 feet and install the rest with a deep open cut trench, and elected to install parallel casings of 30 and 48 inches diameter. Planned initial and supplemental geotechnical investigation. Developed subsurface characterization. Analyzed trenchless alternatives. Prepared contract drawings, specifications, and Geotechnical Baseline Report. Reviewed contractor submittals and oversaw on-site inspector.

Lead Trenchless Engineer; Salmon Creek Wastewater Treatment Plant Columbia River Outfall and Effluent Pipeline Project; Discovery Clean Water Alliance; Clark County, Washington; 2015 to 2022. Trenchless design task lead for a 7,200-foot, 48-inch outfall pipeline for the Salmon Creek Wastewater Treatment Plant, including evaluations of 500- to 900-foot trenchless crossings of waterways, sensitive environmental areas, and a railroad track. Tasks included collecting geotechnical field data, developing the laboratory testing plan, and preparing the geotechnical data report including boring logs. Design tasks included trenchless alternatives analysis, Geotechnical Baseline Report, and design of the 500-foot auger boring railroad crossing, ending in a saturated environmental zone.

Lead Trenchless Engineer & Field Inspection Engineer; Pipeline Main 5.0; Willamette Water Supply Program; Portland, Oregon; 2018 to 2020. Trenchless lead for SW Scholls Ferry Road trenchless crossing for a drinking water transmission system with more than 30 miles of transmission piping. SW Scholls Ferry Road was crossed with auger boring methods, installing an

84-inch steel casing with a length of 75 feet. Performed geotechnical investigation and developed subsurface characterization, including risk of encountering boulders. Design services included auger boring calculations and preparation of design drawings and specifications. Services during construction included submittal review and on-site inspection.

Lead Trenchless Engineer & Field Inspection Engineer; Marys River Water Main Crossings Project; City of Corvallis; Corvallis, Oregon; 2017 to 2019. Trenchless task lead for HDD crossing design of the Marys River with a 1,050-foot 36-inch HDPE pipe for a water main replacement. Performed a trenchless alternatives evaluation for two similar alignments. Designed and analyzed the profile geometry, entry and exit points in congested areas, installation and in-service pipe stresses, and inadvertent returns risk potential for the selected alignment. Design services included preparation of design drawings, specifications, and baseline conditions. Services during construction included submittal reviews and on-site construction inspection.

Lead Trenchless Inspector; T-Line to Busch Drive Transmission Force Main Project; JEA; Jacksonville, Florida; 2018 to 2019. Lead trenchless inspector for construction of four HDD crossings of wetlands and creeks. Contractor installed four 36-inch HDPE crossings ranging from 470 to 2860 LF for wastewater conveyance, in soft to firm clay and loose, fine sand. Reviewed construction submittals, reviewed contractor's daily reports and logs, provided on-site inspection services and real-time analysis, and supervised the work of a team of trenchless inspectors.

Lead Trenchless Engineer & Geotechnical Design Lead; Red Oak Creek Interceptor Project; Trinity River Authority; Dallas, Texas; 2014 to 2019. Geotechnical and trenchless task leads for the replacement of 17,000 LF of 27-inch unlined RCP pipe along Red Oak Creek, including two trenchless installations at the creek and a road undercrossing. Performed a construction method alternatives evaluation for the preparation of the preliminary engineering report. Designed a 120-foot, 60-inch cased auger bore crossing of Shawnee Road, including preparation of design drawings and specifications.

Lead Trenchless Engineer; Kamehameha Highway Wastewater Pump Station Force Main System Improvements Project; City and County of Honolulu; Honolulu, Hawaii; 2016 to 2019. Trenchless design task lead for a 2,200-foot HDD crossing of two streams, which flow into Ke'ehi Lagoon at the crossing location, using 42-inch diameter HDPE. Subsurface conditions included significant thicknesses of very soft marine deposits. Tasks included evaluating subsurface profile, preliminary alignment design, feasibility assessment, analysis of installation and operating stresses and risk of inadvertent returns, and preparation of drawings and trenchless specifications.

Lead Trenchless Engineer & Geotechnical Design Lead; Sangre Road Water Main Replacement, Western Road Booster Pump Station Project, and Range Road Booster Pump Station Project; Stillwater Utility Authority; Stillwater, Oklahoma; 2016 to 2018. Geotechnical and trenchless task leads for three water line new installation projects, totaling approximately 25,000 LF of 16-inch PVC pipe, including several trenchless road, pond, and creek crossings. Performed a trenchless alternatives evaluation for each alignment. Designed three pilot tube guided bores with an innovative pulled-in fusible PVC installation, 600 LF and 900 LF 16-inch HDPE HDD installations, and several small auger bore crossings. Design services included preparation of design drawings, specifications, and baseline conditions. Services during construction included submittal reviews.

Lead Trenchless Engineer; Clover Forcemain Project; Capital Regional District; Victoria, British Columbia; 2017. Lead trenchless engineer for an alternatives evaluation and a review of the indicative design for the Clover Forcemain. The proposed forcemain was a 1350mm diameter HDPE pipe, running the approximately 3.4km length of Dallas Road from McLoughlin Point to Ogden Point. Dallas Road is a landscaped pedestrian, bicycle, and motorized vehicle thoroughfare, which skirts high bluffs and 100-year-old seawalls. The alignment is located in a high-end and historic residential area, requiring careful planning of alignment and workspaces. Tasks included evaluating geologic history and subsurface profile, alignment planning, and alignment alternatives evaluation. Collaborated to produce an Independent Technical Review Summary Report, including several detailed figures.

Trenchless Engineer & Geotechnical Design Lead; Coastal GasLink Pipeline Project; TransCanada Pipelines Ltd; Northern British Columbia; 2017. Geotechnical task lead and trenchless designer for a trenchless crossing of the Sukunka and Highhat Rivers as part of a 670 km NPS 48 natural gas pipeline. Evaluated trenchless technology alternatives for the crossing, including HDD, microtunneling, directional microtunneling, and open cut. Designed a 740 m HDD crossing of the Sukunka and Highhat Rivers. Potential for scour and channel migration was assessed, as well as construction access. Analyzed alternatives for HDD alignments, characterized the subsurface conditions, and developed the feasibility assessment report.

Trenchless Engineer; Colfax Avenue and Lansing Street Storm Sewer Improvements; Aurora Water; Aurora, Colorado; 2016 to 2017. Trenchless designer for two crossing alternatives of Colfax Avenue, including a 42-inch cased auger boring crossing or a 24-inch pilot tube guided boring crossing, to carry stormwater runoff. Analyzed alternatives for trenchless methods and alignments, characterized the subsurface conditions, and developed the Geotechnical Baseline Report, specifications, and drawings. Provided services during construction including submittal reviews.

Lead Trenchless Engineer; Ada County Landfill; Ada County, Idaho; Boise, Idaho; 2017. Trenchless design lead for 59-foot and 75-foot crossings of landfill access roads for a 36-inch Sanitite polypropylene stormwater system. Designed the road crossings with auger bored installations of 54-inch steel casings. Design services included preparation of design drawings, specifications, and baseline conditions.

Lead Trenchless Engineer and Geotechnical Design Lead; Hillside Terrace Estates Sanitary Sewer Replacement; City of Amarillo; Amarillo, Texas; 2014 to 2016. Geotechnical and trenchless design task lead for 30-inch sanitary sewer replacement of a failing, 8,420-foot clay pipe system. Tasks included developing the scope of work, including conceptual exploration plan and subcontractor scope of work, and performing risk assessment for proposed trenchless design. Project included identifying and evaluating options for pipeline replacement and/or rehabilitation, managing a subcontractor for geotechnical investigation and data report, preparing the preliminary engineering report, design of the replacement sanitary sewer for microtunneling or pilot tube guided boring, and preparation of geotechnical baseline report, tunneling specifications and drawings. Contractor elected to complete the majority of the work with deep open cut, with trenches up to 50 feet deep. Services during construction include assisting the client with construction submittals, RFIs, and a construction claim.

Lead Trenchless Engineer; Ridgeway Line/Rueter-Hess WISE Infrastructure Project; Parker Water and Sanitation District; Parker, Colorado; 2014 to 2017. Trenchless design task lead for approximately 4 miles of 36-inch potable water pipeline, which included five trenchless crossings of roads, highways, and streams. Tasks included risk assessment for proposed trenchless designs and developing an exploration plan. Design included evaluating trenchless construction alternatives, design of trenchless crossings, and preparation of trenchless design report, geotechnical baseline report, drawings, and specifications. Reviewed contractor submittals for construction, and supported owner through a potential claim.

Lead Trenchless Engineer & Field Inspection Engineer; Davis-Woodland Water Supply Project; Woodland-Davis Clean Water Agency; Woodland, California; 2014 to 2015. Designed HDD alignments for two 42-inch raw water supply pipeline crossings ranging from 769 to 1,095 linear feet. Analyzed installation stresses, operating stresses, allowable downhole pressures, borehole collapse, and pipe deflection. Developed soil properties and parameters necessary for design. Performed tunnel inspection for construction of the 42-inch-diameter, 1,095 LF HDD crossing of the Tule Canal and the Yolo Bypass East Levee (USACE flood protection levee) through clay underlain by medium dense sand. The crossing also passed beneath an 8-inch-diameter high pressure gas line. The HDPE DR11 carrier pipe was pulled directly into the borehole. Performed tunnel construction inspection services in accordance with the technical specifications, monitoring drilling progress and pressures during pilot hole drilling, reaming, and pipe pullback.

Lead Trenchless Engineer and Geotechnical Design Lead; Corral Hollow Road Utility Improvements Project; City of Tracy; Tracy, California; 2013 to 2015. Geotechnical and trenchless design task lead for a new water and wastewater conveyance system to serve a new residential development, including approximately 2 miles of 30-inch diameter water pipeline, 2 miles of dual sewer force mains, 2 miles 21-inch gravity sewer pipeline, and an approximately 6 MGD wastewater pump station. Pipeline alignment included twin, 580- to 730-foot HDD crossings of two major water supply canals; twin, 100-foot, 42-inch auger bored crossings of UPRR tracks; a 25-foot pipe rammed crossing of an irrigation canal; and underground pipeline structures and pump station wet well. Coordinated geotechnical investigation and developed laboratory testing program. Performed borehole logging and sampling. Performed risk assessment for trenchless work. Developed soil properties and parameters necessary for design and provided guidance on subsurface conditions affecting trenchless construction. Performed analysis of HDD crossings including installation stresses, operating stresses, allowable downhole pressures, borehole collapse, and deflection. Prepared geotechnical data report, design report, and Geotechnical Baseline Report. Developed drawings and specifications for construction.

Lead Trenchless Engineer; Cheyenne Vulcan UPRR Project; Union Pacific Railroad; Cheyenne, Wyoming; 2015 to 2017. Designed the HDD alignment and performed the analysis for a 576-foot crossing of several active railyard tracks with an 8-inch steel casing for communications. Analyzed installation stresses, operating stresses, allowable downhole pressures, and breakover curve. Developed soil properties and parameters necessary for design. Developed specifications and drawings for the crossing. Reviewed contractor submittals for the construction phase, and was part of a team to successfully plan and implement an emergency alignment change when an unanticipated obstruction was encountered by the contractor.

Tunnel Inspection Engineer and Construction Services; Magnolia Pipeline Project; El Paso Water Utilities; El Paso, Texas; 2014 to 2016. Prepared geotechnical baseline report for tunneling construction bids on storm drainage pipeline project, including 84-inch diameter gravity collection pipeline and 60-inch pressure discharge pipeline into the Rio Grande. Gravity pipeline segment includes 3 tunneled crossings of highways and railroads of up to 450 feet in length with 102-inch liner plate and 96-inch steel casing, while the pressure pipeline included 4 crossings of roadways, canals, and Rio Grande levee of up to 450 feet in length utilizing 78-inch steel casing, 102-inch steel ribs and steel lagging, and 102-inch steel liner plate. Subsurface conditions consist of uniformly-graded dry running sands. Prepared a Geotechnical Baseline Report for crossing of the Franklin Canal. Reviewed and responded to technical construction submittals related to tunnel construction. Monitored survey data results for real-time settlement analysis. Performed tunnel inspection services in accordance with the technical specifications and monitored surface and subsurface settlement resulting from tunneling activities for two, 87.5--inch--diameter crossings by open-face digger shield in running sands. Performed tunnel inspection services and trained junior engineers and tunnel inspectors for crossings of the Franklin Canal and the Rio Grande Levee.

Trenchless Inspection Engineer and Construction Services; Bend Southeast Interceptor Project; City of Bend; Bend, Oregon; 2015. Tunnel inspector for construction of a 36-inch-diameter, 323 LF crossing of active BNSF tracks through basalt rock using a Robbins small-diameter SBU-M with a vacuum spoils removal system. This project was the first use of a machine of this kind in North America. Reviewed and responded to technical construction submittals related to tunnel construction. Performed tunnel construction inspection services in accordance with the technical specifications and monitored surface settlement survey data.

Trenchless Engineer and Field Investigation Engineer; Faro Mine Remediation Project; Government of Yukon; Faro, Yukon, Canada; 2015 to 2016. Assessed tunnel feasibility for a road crossing and performed geotechnical field investigation at a remote site for the design of a dam and creek diversion related to water management activities for the closure and remediation of the Faro Mine. The Faro Mine began operations in 1969 and became one of the largest open-pit lead and zinc mines in the world. Mining continued until 1998. The site includes three pits, 55 million tons of tailings held in a valley with several dams, 366 million tons of waste rock, a water treatment plant, and abandoned mine buildings. Trenchless design tasks included assessing feasibility of 30-foot-diameter tunnel to cross a 120-foot-high access road embankment with a relocated creek. Conducted initial desktop study, including route option development. Evaluated thermistor data to assess temperatures within the soil column. Performed analysis of tunneling techniques and feasibility of tunnel construction using box jacking, SEM with shotcrete, or pipe roofing techniques. Prepared recommendations report and cost estimate. Field tasks included logging soil borings and rock cores, collecting soil samples and rock cores, performing Packer tests, installing groundwater monitoring wells, and collecting thermistor data.

Lead Trenchless Engineer; Fort Irwin W46 Fire Flow Improvement to ASP; Fort Irwin, California; 2014 to 2015. Trenchless design task lead for 130-foot road crossing for 1-mile, 10-inch water line. Planned the site investigation and laboratory testing program, and performed conceptual analysis of trenchless construction options. Developed drawings and specifications for the design.

Trenchless Engineer; Wapiti to Kakwa Expansion; Pembina Pipeline Company; Alberta, Canada; 2015. Trenchless engineer for design and construction of HDD installation of 16-inch gas

transmission main including 24 HDD crossings of streams up to 1,400 feet in length. Performed all analyses of installation and operational stresses including factor of safety against inadvertent returns and borehole collapse. Developed soil and rock properties and parameters necessary for design and provided guidance on subsurface conditions affecting construction. Generated drawings for the design.

Tunnel Inspection Engineer; Eastern New Mexico Rural Water System; Eastern New Mexico Rural Water Authority; Ute Reservoir, New Mexico; 2014. Performed tunnel inspection services for construction of a 60-inch-diameter, 233-foot-length microtunneled intake pipeline direct-jacked through relatively weak sandstone. The sandstone contained extensive zones of highly-fractured rock, resulting in hydraulic connection to the lake with high groundwater inflows to the shaft. The tunnel was constructed under 60 feet of head from the lake surface and was bored from the 80-foot-deep jacking shaft to an exit portal constructed underwater in the bank of the Ute Reservoir. Wet recovery of the microtunnel boring machine recovery was performed with the assistance of a dive team. Performed tunnel construction inspection services in accordance with the technical specifications and monitored surface ground movement near the exit location.

Field & Design Engineer; Kellogg Creek WPCP Outfall Improvements Project; Clackamas County WES; Milwaukie, Oregon; 2014 to 2015. Performed the overwater geotechnical investigation from a barge, locating and logging the boreholes and collecting soil samples. Developed the laboratory testing plan, analyzed the results, and prepared the Geotechnical Data Report and the geotechnical design recommendations for a 175 LF, 48-inch-diameter steel outfall extension pipe anchored with two steel pipe piles in loose sand and gravel with cobbles.

Tunnel Inspection Engineer; Kaiser Pond Fish Screen and Shinn Gravity Rediversion No. 2; Alameda County Water District; Fremont, California; 2012 to 2013. Coordinated the field investigation for seven geotechnical borings. Performed slope stability analysis for existing retention pond levees. Performed tunnel inspection services for a 72-inch-diameter auger boring crossing of active railroad tracks through sand and gravel with cobbles.

Design Engineer; Everett Conveyance Project; City of Snohomish; Snohomish, Washington; 2012. Performed HDD analysis for the 1,750-foot-long undercrossing of the Snohomish River through challenging glacial deposits for design of a new pump station and 20-inch-diameter force main pipeline to transport water from the city of Snohomish to the city of Everett. Analyzed installation stresses, operating stresses, allowable downhole pressures, borehole collapse, and pipe deflection. Developed soil properties and parameters necessary for design.

Project Engineer; Wastewater Treatment Plant Outfall Pipeline Project; City of Tracy; San Joaquin County, California; 2011 to 2012. Developed soil properties and parameters necessary for pipeline design and conceptualized the subsurface conditions along the pipeline alignment for design of approximately 20,000 feet of 42-inch-diameter pipe, including a tunneled crossing of the Old River and associated south USACE jurisdictional levee with deep access shafts and an associated in-river outfall. Assisted with the geotechnical report for the open-cut and tunneled portions of the project.

Design Engineer; Southern Delivery System Pipeline Alignment; Colorado Springs Utilities; Colorado; 2011 to 2012. Performed soil analysis, conceptualized subsurface conditions, and prepared reports for a 40-mile section of 66-inch-diameter pipeline for the Southern Delivery

System. Design efforts included construction considerations through steep, mountainous, and rocky terrain, and tunneling operations through rocky terrain, under highways, and year-round Fountain Creek.

Publications

Worthen, Diana. 2019. Horizontal Bends in Horizontal Directional Drilling. North American Society for Trenchless Technology No-Dig Conference. Chicago, Illinois. March. Paper # TM2-T1-01.

Worthen, Diana, Desiree Willis, and Larry Stadel. 2016. New Trenchless Boring Method Successful in Oregon Crossing. Pacific Northwest Trenchless Review. NASTT Pacific Northwest Chapter.

Clever, Kenny, Diana Worthen, and Larry Stadel. 2016. Use of a Novel Boring Machine for a Line-and-Grade Sensitive Trenchless Crossing Through Hard Rock in Bend, Oregon. North American Society for Trenchless Technology No-Dig Conference. Dallas, Texas. March. Paper # WM-T2-01.

Worthen, Diana, Andrew Finney, and Stephanie Harrison. 2015. Underwater Tunnel: Microtunneling the ENMRWS Raw Water Intake Tunnel at Ute Reservoir. North American Society for Trenchless Technology No-Dig Conference. Denver, Colorado. March. Paper # TA-T5-04.

Muhunthan, Balasingam, and Diana L. Worthen. 2011. Critical state framework for liquefaction of fine grained soils. Engineering Geology, vol. 117, no. 1, pp. 2-11.

Professional Involvement

North American Society for Trenchless Technology (NASTT) instructor for Horizontal Directional Drilling Good Practices course – 2019 to present.

Committee for 3rd Edition of ASCE Manual of Practice 108 Horizontal Directional Drilling, contributing author for a chapter – 2021 to present.

Session Leader for the 2016, 2017, and 2018 NASTT No-Dig Conferences, reviewing and evaluating 4 papers and presentations for the HDD Track in each year.

NASTT member – 2015 to present.

Leader for the Jacobs Community of Practice for New Installation Trenchless – 2018 to 2021.

2016 editor for Stratum, CH2M's global newsletter for the Tunnels and Earth Engineering group.

Education

M.S., Civil Engineering, Washington State University, 2009

B.S., Civil Engineering, Washington State University, 2007

Employment History

Cascade Trenchless Consulting, Principal Engineer and Owner, 2022 to present. Integrating with design teams to deliver trenchless solutions for water & wastewater, energy, and other pipeline projects. Providing expertise in feasibility and alternatives analyses, geotechnical investigation plans,

risk identification and mitigation, design calculations and developing contract drawings and specifications, and services during construction including on-site inspection.

Jacobs Engineering Group, Project Engineer, 2018 to 2022. Performed design and analysis for trenchless installations; prepared geotechnical data reports, technical memorandums, and geotechnical baseline reports; developed design drawings and specifications; led and performed field investigations, trenchless alternatives analyses, and trenchless design calculations; provided services during construction including on-site inspection and submittals review.

Note: Jacobs Engineering Group acquired CH2M Hill in 2018.

CH2M Hill, Project Engineer, 2011 to 2018. Performed design and analysis for deep and shallow foundations, slope stability, and trenchless crossings; wrote geotechnical data reports, technical memorandums, and geotechnical baseline reports; developed design drawings and specifications; performed trenchless alternatives analyses, site-specific seismic analyses, field investigations, and trenchless construction inspection.

PBS Engineering + Environmental, Staff Engineer, 2009 to 2011. Performed design and analysis for deep and shallow foundations and slope stability; wrote geotechnical data reports, geotechnical recommendation reports, and site-specific seismic analyses; and performed field investigations and construction monitoring.

Washington State University, Graduate Student Instructor and Teaching Assistant, 2006 to 2008. Taught Mechanics of Materials (prepared all class lectures, lectured, assigned homework, wrote and graded exams). Taught Geotechnical Engineering Soils Lab and Technical Drafting Lab (lectured, supervised in-class lab activities, and graded lab reports and drafting homework assignments).

GeoEngineers, Geotechnical Intern, 2007. Performed soils lab testing, field investigations, and construction monitoring. Developed an operating guide for the soils lab.